We claim:

1. A method of transmitting data in a communication system, comprising the steps of:

encoding bits of a data stream with nonsystematic repeat-accumulate codes; and

mapping the encoded bits to a signal for transmission.

2. The method of claim 1, wherein the encoding step includes:

first encoding bits of the data stream with repetition codes to obtain first encoded bits;

re-ordering a bit order of the first encoded bits based on an interleaving process;

second encoding the re-ordered first encoded bits with parity check codes to obtain second encoded bits;

accumulating the second encoded bits to obtain nonsystematic repeat-accumulate coded bits; and

subjecting the nonsystematic repeat-accumulate coded bits to an interleaving process prior to the mapping step for facilitating decoding of the transmitted signal when received at a receiver.

3. The method of claim 1, wherein the encoding step includes:

first encoding bits of the data stream with repetition codes to obtain first encoded bits;

re-ordering a bit order of the first encoded bits based on an interleaving process;

second encoding the re-ordered first encoded bits with parity check codes to obtain second encoded bits; and

accumulating the second encoded bits to obtain nonsystematic repeat-accumulate coded bits for the step of mapping.

4. A method of decoding data in a communication system, comprising the steps of:

detecting one or more transmitted signals of a data stream encoded with nonsystematic repeat-accumulate codes to obtain a detection output; and

decoding the detection output to obtain a decoded stream of bits for reconstructing the data stream.

5. The method of claim 4, wherein the detection output is a plurality of channel reliability values representing nonsystematic repeat-accumulate coded bits of at least one of the transmitted signals.

6. The method of claim 5, wherein the decoding step includes:

first decoding the plurality of reliability values to obtain a first output; and

second decoding the first output to obtain a second output; and

third decoding the second output to obtain a third output that is fed back for the second decoding and then the first decoding to complete a decoding iteration that provides decoding information for a next decoding iteration.

7. The method of claim 6, wherein

the first decoding step further includes performing an a posteriori probability decoding process to obtain the first output,

the first output is a first set of log-likelihood ratio values representing partially decoded bits from decoding nonsystematic repeat-accumulate encoded bits of at least one of the transmitted signals, so that the partially decoded bits reflect bits of the data stream that have been subject only to repetition encoding and parity-check encoding at a receiver.

8. The method of claim 7, wherein

the second decoding step further includes generating the second output from the first set of log-likelihood ratio values, and

the second output is a second set of log-likelihood ratio values representing partially decoded bits that have had non-systematic repeat accumulate codes and parity check codes decoded, so that the partially decoded bits reflect bits of the data stream that have been subject only to repetition encoding at the receiver.

9. The method of claim 8, wherein the second decoding step includes performing an a posteriori probability decoding process based on the first set of log-likelihood ratio values and an input feedback value to generate the second output.

10. The method of claim 8, wherein

the third decoding step further includes generating the third output from decoding the second set of log-likelihood ratio values, and

the third output is a third set of log-likelihood ratio values representing completely decoded bits of the data stream.

11. The method of claim 10, wherein the third decoding step includes performing an a posteriori probability decoding process based on the second set of log-likelihood ratio values

12. The method of claim 6, wherein

the first, second and third outputs are modeled in advance, each by a corresponding transfer characteristic curve that accounts for the nonsystematic repeat-accumulate codes for at least one transmitted signal, and

the transfer characteristic curve modeling the third output is fit to the transfer characteristic curves of one or both of the first and second outputs to facilitate decoding the transmitted signals at a highest possible data rate with a lowest possible bit error rate.

13. A combined detector/decoder arrangement for a receiver in a communication system, comprising:

a detector for performing a bit detection from channel information received on one or more channels to provide a detector output;

a first node decoder for determining extrinsic values from the detector output for use as a priori knowledge by the detector for a next bit detection iteration, and for outputting reliability values, wherein the detector and first node decoder are represented by a first transfer characteristic curve; and

a second node decoder for determining modified reliability values from the received reliability values, wherein the second node decoder is represented by a second transfer characteristic curve adapted so as to substantially match the first transfer characteristic curve.

14. The arrangement of claim 13, wherein matching of the transfer characteristic curves on a transfer chart facilitates decoding the received channel information at a highest possible data rate with a reduced bit error rate by leaving an open convergence tunnel in the transfer chart.

15. The arrangement of claim 13, wherein the detector includes:

an inner detection loop having a multiple-input, multiple output (MIMO) detection portion for performing a posteriori probability bit detection on the received channel information to output soft bits to the first node decoder, and an accumulator decoder to perform an a posteriori probability decoding process to feedback a priori knowledge to the detection portion for a next bit detection iteration at the detection portion .

16. The arrangement of claim 13, wherein the detector performs MIMO trellis detection on the received channel information for providing soft bits to the first node decoder, and accumulator decoding to feedback a priori knowledge for a next MIMO trellis detection iteration.

17. The arrangement of claim 13, wherein

the detector output represents channel reliability values for a nonsystematic repeat-accumulate coded bit-stream, and

the first node decoder is a combination of an accumulator decoder and a check node decoder that includes a check node layer having a small fraction of degree one check nodes to decode the nonsystematic repeat-accumulate coded bit-stream.

18. The arrangement of claim 17, wherein the reliability values output from the check node decoder represent partially decoded bits of the received channel information that have had non-systematic repeat accumulate codes and parity check codes decoded, so that the partially decoded bits reflect bits of the channel information that have been subject only to repetition encoding at a receiver.

19. The arrangement of claim 13, wherein

the second node decoder is a variable node decoder comprising k variable nodes to decode bits of the reliability values received from the first node decoder, wherein the modified reliability values output from the variable node decoder reflect completely decoded bits of the channel information.

20. A modulation and coding scheme for a communication system, the modulation and coding scheme based on the use of nonsystematic repeat-accumulate codes for encoding channel information for transmission, and

employing a combined detection and decoding arrangement to decode the coded channel information.